

## Sheldrake, Sean

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**From:** Sheldrake, Sean  
**Sent:** Thursday, February 18, 2016 1:04 PM  
**To:** bayuk.dana@deq.state.or.us  
**Cc:** Lance Peterson (PetersonLE@cdmsmith.com)  
**Subject:** FW: Gasco Groundwater Modeling Workshop Presentation - Action Items  
**Attachments:** USGS\_ModelGrid\_RainGages.pdf; table3 - AQ.XLSX

Hi Dana,

EPA reviewed the data included in the completed Table 3 and supplemental map sent via email from Anchor on February 3, 2016. We feel this information satisfies the request for precipitation backup. Consistent with Anchor's presentation at the model workshop on December 2, 2015, annual rainfall totals taken from the Tualatin Hills (sites 2, 147, and 58) and those taken from the valley (sites 160, 125, and 1) are similar in magnitude, with no evidence that the hills receive more rainfall than the valley. In Snyder et al. (1994), the authors estimated groundwater recharge to the uplands using a rainfall input that assumed values on the order of 45 to 60 inches per year, based on the higher altitude. We concur that these estimates made by Snyder et al. are high. Based on the data provided, an average annual rainfall rate in the 37-39 inches per year range for the Gasco site seems appropriate.

Let me know if you'd like to discuss or have any questions.

Thank you.

S

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**From:** Jen Mott [<mailto:jmott@anchoragea.com>]  
**Sent:** Wednesday, February 03, 2016 8:01 AM  
**To:** Dana Bayuk <[BAYUK.Dana@deq.state.or.us](mailto:BAYUK.Dana@deq.state.or.us)>

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**Subject:** RE: Gasco Groundwater Modeling Workshop Presentation - Action Items

Dana,

The following email is provided on behalf of Pradeep.

Dana,

Thanks for the approvals of our recommendations on transducer installation and on the additional flows from the basalt. As per DEQ's request we will add a transducer at MW-40F. We expect to perform the installations shortly, and will send a confirmation e-mail after the installations.

We acknowledge that Table 2 is still due to DEQ. We expect to complete that in the next couple of weeks.

We have completed DEQ's request for precipitation information (Table 3 – please see attached). DEQ has requested records going back to 1986. The City of Portland HYDRA (USGS) stations do not extend that far back. Therefore, we have included NOAA stations from the Portland area that does extend farther back. These stations are not as close to the Gasco site as the HYDRA stations, but provide a regional long-term record for comparison (see attached map). We have also included summary statistics (average, minimum and maximum for periods of record) in the last few columns which were not originally in DEQ's table. The average rainfall shows that the HYDRA data and NOAA data are consistent over the periods of record. If you have any questions please let me know.

Thanks.

Pradeep

Thank you,  
Jen Mott ©  
(formerly Jen Woronets)  
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**From:** BAYUK Dana [<mailto:BAYUK.Dana@deq.state.or.us>]

**Sent:** Tuesday, January 26, 2016 6:19 PM

**To:** Pradeep Mugunthan <[pmugunthan@anchoragea.com](mailto:pmugunthan@anchoragea.com)>

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**Subject:** RE: Gasco Groundwater Modeling Workshop Presentation - Action Items

Hello Pradeep.

DEQ is following up on the action items from the December 2, 2015 groundwater modeling workshop (Workshop). Action items are summarized in your December 10, 2015 e-mail (see below).

As indicated in your December 10<sup>th</sup> e-mail, during the Workshop NW Natural presented recommendations and supporting information for modifying the model by adding groundwater flux into the Alluvium WBZ from the basalt. In addition, NW Natural and DEQ agreed that:

- NW Natural will:
  - Provide a soft copy of the Workshop presentation;
  - Propose a list of uplands Fill WBZ monitoring wells for the installation of transducers;
  - Complete columns R, S, and T of Table 2 (Groundwater Recharge Components within Gasco Groundwater Model Domain) by estimating a conceptual water balance to the Fill WBZ that includes recharge, evapotranspiration, runoff, and any other relevant component of the water balance at the site.
- DEQ will review NW Natural's:
  - Recommendation made during the Workshop to refine the alluvial zone calibration with 150 to 200 gpm of additional flows introduced from the basalt, divided between the Lower and Deep Lower Alluvium;
  - Proposal to monitor groundwater levels in certain Fill WBZ monitoring wells using transducers.
  - Revisions to Table 2 for our evaluation of the Fill WBZ recharge values used in the model.

DEQ received the Workshop presentation and the recommendation for instrumenting Fill WBZ installations on December 10 and December 22, 2015, respectively. To date, DEQ has not received the completed version of Table 2.

Based on our review of the first two items listed above, DEQ approves:

- Moving forward with model calibration of the Alluvium WBZ consistent with NW Natural's workshop recommendation to add 150 to 200 gpm of flux into the model via the basalt; and
- NW Natural's recommendation to instrument four monitoring wells in the Fill WBZ (i.e., MW-10-25, MW-11-32, NWN-13-23, NWN-7-30) with the addition of MW-40F to the list.

Regarding Table 2, DEQ considers the table necessary for our evaluation and review and approval of the Fill WBZ recharge values used in the model. In other words, although DEQ approves moving forward with calibration of the Alluvium WBZ, DEQ's approval of model calibration overall also requires our approval of the recharge values used for the Fill WBZ.

For clarification and to avoid misunderstandings, DEQ's October 6, 2015 direction for NW Natural to modify the K-values of the upper silt should be followed during calibration. DEQ's direction required that horizontal and vertical K-values representative of the silt be used in the model domain, including in areas along the shoreline where the silt is interpreted to be thin or absent.

Note that regarding the model process moving forward, EPA and DEQ are becoming familiar with the weather station data and data analyses used to develop the revised groundwater recharge rates presented during the workshop. To assist us in evaluating the data, DEQ requests that the attached Table 3 (Rainfall Data Summary) be completed for our information and use. DEQ anticipates using Table 3 for developing comments relevant to NW Natural's model sensitivity analyses and transient modeling simulations.

Thank you Pradeep for providing the information EPA and DEQ requested during the workshop. Please feel free to contact me with questions regarding this e-mail.

Dana

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**From:** Pradeep Mugunthan [<mailto:pmugunthan@anchorgea.com>]

**Sent:** Thursday, December 10, 2015 10:52 AM

**To:** BAYUK Dana; John Edwards; Mike Riley; Miao Zhang; Binglei Gong; John Renda; Sean Sheldrake; Lance Peterson ([PetersonLE@cdmsmith.com](mailto:PetersonLE@cdmsmith.com)); Matt Gamache ([gamachem@cdmsmith.com](mailto:gamachem@cdmsmith.com)); LARSEN Henning; Rob Ede; Carl Stivers; Ben Hung; Eva DeMaria ([DeMaria.Eva@epa.gov](mailto:DeMaria.Eva@epa.gov)); 'Mike Murray'; James Peale ([jpeale@maulfoster.com](mailto:jpeale@maulfoster.com)); Myron Burr ([myron.burr@siltronic.com](mailto:myron.burr@siltronic.com)); 'Coffey, Scott'

**Cc:** Bob Wyatt; Patty Dost; Sarah Riddle; Jen Woronets

**Subject:** Gasco Groundwater Modeling Workshop Presentation - Action Items

Dana,

Per our conversation yesterday I have summarized the action items from the Workshop that we discussed.

1. Anchor QEA will provide the presentation from the Workshop (this task has been completed per Jen's e-mail below)
2. Anchor QEA will provide a proposal to install transducers in existing upland Fill WBZ wells
3. Anchor QEA will develop a conceptual model of recharge to the Fill WBZ and calculate the blank columns in Table 2 that was provided to DEQ on 11/3/15, based on estimated runoff and evapotranspiration
4. DEQ will provide feedback on the proposal to refine the alluvial WBZ calibration with additional inflows from basalt to lower and deep lower alluvium. This proposal is available in the "Next Steps" slide from our Workshop presentation.

Please add to this if I have missed anything.

Thanks.  
Pradeep

**Pradeep Mugunthan, Ph.D., P.E.**

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**From:** Jen Woronets

**Sent:** Thursday, December 10, 2015 12:28 PM

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**Subject:** December 2, 2015 Gasco Groundwater Modeling Workshop Presentation

All –

Attached please find the December 2, 2015 Gasco groundwater modeling workshop presentation.

Please contact Pradeep Mugunthan with any questions.

Thank you,  
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